

Enhancing Income and Sustainability through Intercropping in Oil Palm Plantations

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Abstract

Intercropping in oil palm plantations, both in young and mature stages, offers significant benefits for smallholder farmers by enhancing land productivity and providing diversified income sources. In young plantations, crops like maize, beans, and sweet potato help bridge the income gap before oil palm yields, while also supporting soil fertility and reducing weeding costs. In mature plantations, shade-tolerant crops such as yam, cacao, and vanilla offer high-value alternatives, though their yields may be affected by reduced light. Managing canopy cover and selective pruning is essential to balance oil palm and intercrop productivity. Overall, intercropping promotes sustainability and food security while improving the economic viability of oil palm farming

Introduction

Oil palm (*Elaeis guineensis*), a versatile crop originally from the tropical rainforests of West Africa, has found significant cultivation in India, particularly in regions like Tamil Nadu, Andhra Pradesh, Telangana and Maharashtra. The tree thrives under specific environmental conditions, such as temperatures between 25–28°C, a minimum of 5 hours of sunlight daily, and evenly distributed rainfall of 1800–2400 mm annually. It is well-suited for low-altitude areas and rich, free-draining soils, although it can adapt to poorer soils with adequate fertilization. Oil palm cultivation in India has expanded, partly due to government support for smallholder farmers and the rising demand for vegetable oil.

In the juvenile phase of oil palm plantations, intercropping plays a critical role in managing land and enhancing farm income. Since oil palm takes 3–4 years to produce fruit, intercropping with crops like maize, groundnut, and legumes offers supplementary income and helps improve soil fertility. The practice of intercropping during this phase is increasingly popular among Indian smallholders, as it helps reduce weeding costs and optimizes space that would otherwise remain unused. Research in India has shown that intercropping does not adversely affect the growth of young oil palms and, in some cases, can enhance biomass accumulation, benefiting the palm trees later on (Reddy *et al.*, 2004). The practice has been implemented successfully in regions such as Maharashtra's Konkan and Andhra Pradesh, where crops like banana, pineapple, and elephant foot yam are commonly cultivated alongside young oil palms (Gawankar *et al.*, 2018, Dhandapani *et al.*, 2024). These intercrops not only provide additional income but also contribute to reducing the cost of weeding and fertilization. For example, studies from Maharashtra found that banana cultivation yielded about Rs. 55,833 per hectare, while elephant foot yam and pineapple generated Rs. 61,950 and Rs. 27,500, respectively (Gawankar *et al.*, 2018). Legumes such as soybean and groundnut also play a vital role by fixing nitrogen in the soil, enhancing the fertility of the land and benefiting the oil palm growth

In mature oil palm plantations, intercropping continues to offer potential benefits, though the practice is less widespread due to the challenges of managing large plantations and limited space. However, in mature plantations where 60–65% of the land remains vacant, shade-tolerant crops such as yam, vanilla, and cacao have been successfully grown. In India, farmers have adopted similar practices, especially in regions like Kerala, Andhra Pradesh, and Tamil Nadu, where oil palm plantations are well-established. Intercropping in mature plantations helps diversify income streams while maintaining land productivity. The careful management of canopy cover and light exposure is essential to prevent competition between the intercrops and oil palm trees.

Despite these challenges, intercropping remains a promising strategy for improving the sustainability and profitability of oil palm cultivation in India (Suresh and Rethinam, 2001; Vasanthkumar, 2005).

Comparison of monocropping and intercropping oil palm in India:

Monocropping	Inter cropping
Maximizes oil palm yields, suitable for large-scale production and focused on commercial oil output	Allows diversification with food, fodder, or timber crops, providing income stability for smallholders
Facilitates mechanization, as single-crop systems are easier to manage with heavy machinery	Mechanization can be challenging due to diverse crops, but smaller-scale farmers often benefit overall
Increases soil nutrient depletion and vulnerability to pests and diseases	Enhances soil health with legumes that add nitrogen, reducing fertilizer needs
Risks biodiversity loss and ecological imbalance, impacting long-term sustainability	Increases biodiversity and resilience, which are important for local ecosystems and adapting to climate
Reduces the ecosystem services provided by mixed cropping systems, like pest control and improved climate	Mixed systems improve biodiversity, ecosystem services, and local microclimates, helping farmers adapt

Intercultural operations to be followed in mature oil palm plantation

- **Pruning:** To ensure adequate light for intercrops, farmers may need to selectively prune the oil palm trees. However, excessive pruning can harm palm growth and reduce oil palm yields, so finding the right balance between palm growth and intercrop productivity is crucial.
- **Crop Spacing:** Intercropping works best when crops like cacao, vanilla, and yams are planted in the gaps between widely spaced oil palms, reducing competition for light and nutrients. This setup helps ease management practices and makes weeding more efficient.
- **Soil Health:** Tubers like yam and sweet potato can enhance soil health by improving its structure and aeration. Their deep roots help break up compacted soil, benefiting both the intercrops and the oil palms.

In India, integrating shade-tolerant intercrops into mature oil palm plantations is still evolving, but early experiences show positive results, with farmers enjoying better economic returns and more sustainable use of their land. However, more research is needed to optimize the management of pruning, crop rotation, and yield trade-offs between oil palms and intercrops for long-term productivity

Table 1 Commonly grown intercrops during the early years of oil palm cultivation in India

Crop Type	Crops	Benefits
Cereal Crops	Maize, Sorghum	Provides food, additional income, and ground cover
Legume crops	Soybean, Groundnut, Peas, Beans	Enriches soil through nitrogen fixation
Root crops	Sweet Potato, Cassava, Yam	Food security, and helps in soil cover

Vegetable crops	Tomatoes, Brinjal, Chilli, Okra and gourds	Provides quick returns and .food for local markets
Tuber crops	Potato, Yam, Ginger	Quick growing, providing .food and additional income
Perennial crops	Banana, Pineapple	Multiannuals that provide .continuous income

Table 2: Intercropping in Mature Oil Palm Plantations:

Crop	S h a d e Tolerance	Potential Benefits	Notes
Yam	High	Provides food and income; low maintenance; .helps with soil aeration	Grows well in the gaps between palms; minimal .competition for light
Sweet potato	High	Fast-growing, edible tuber; improves soil .health; food security	Ideal for intercropping; low maintenance, high .yield
Cocoa	Moderate	High-value crop; provides alternative income; .chocolate demand	Grows well under partial shade, but yields may be lower compared to open .spaces
Vanilla	Moderate	High market value; profitable under shade	Requires careful management and pruning to avoid .competition
Cassava	High	Provides food and income; drought-tolerant; .minimal input needed	Suitable for semi-shaded conditions; low competition with oil palms
Pine apple	Moderate	High-value fruit; marketable; generates income quickly	Grows well in the semi-shaded areas between palms
Banana	Moderate	Continuous income; stabilizes soil; helps control .erosion	Thrives in partially shaded environments; good for intercropping with oil .palms
Peanut	Moderate	Nitrogen-fixing, improves soil fertility; provides food and income	Suitable as a short-term intercrop; helps reduce .costs of fertilization
Soyabean	Moderate	Fixes nitrogen in the soil; provides food and .income	Good companion crop for intercropping, enriching soil for oil palms

Conclusion

Intercropping in both young and mature oil palm plantations provides opportunities to improve farm profitability and sustainability. In young plantations, crops like beans, maize, and sweet potato offer early income and support soil fertility. In mature plantations, shade-tolerant crops such as yam, cacao, and vanilla diversify income while maintaining land productivity. However, managing light levels and pruning is crucial to balance oil palm yields and intercrop productivity. Careful selection and management of intercrops can enhance long-term economic and environmental benefits for farmers









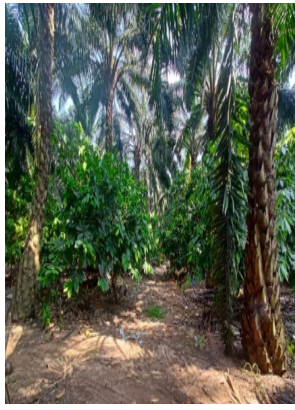
		
Oil palm+ Bhendi	Oil palm+ Watermelon	Oil palm+ Chilli
		
Oil palm+ Bottle gourd	Oil palm+ Ridge gourd	Oil palm+ Ground nut
		
Oil palm+ Banana	Oil palm+ Papaya	Oil palm+ Cocoa

Fig 1 Intercropping of different seasonals, Annuals, biennials and perennials crops in oil palm cultivation

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